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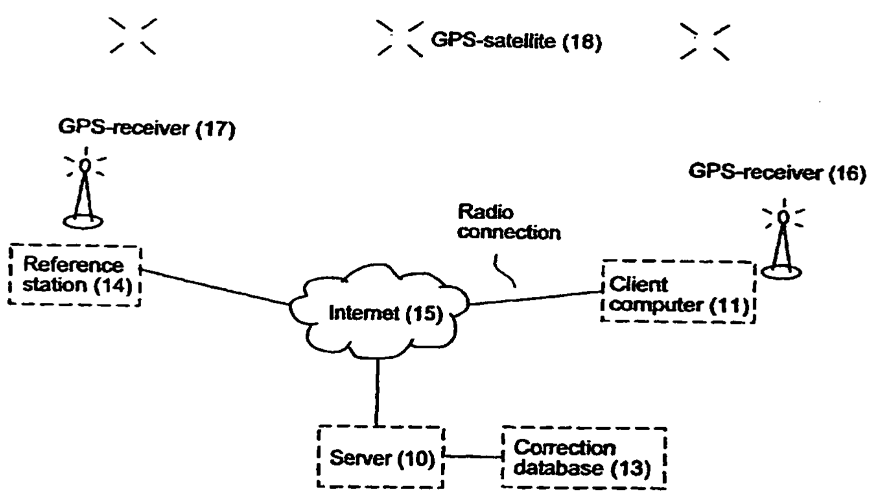

(57) Abstract: An arrangement, at a wireless communication system, to, by utilisation of a positioning system (18), supply a mobile user client (11) with best possible positioning information by adjustment of the positioning information that is obtained from the positioning system. The adjustment is depending on imperfections in the positioning system and the user client's position. The user client communicates over a two-way connection, for instance an open communication network, with device (10), which creates basic data for adjustment of the positioning information that is obtained from the positioning system. The device, which obtains the basic data for correction from a number of reference stations (14) with accurately appointed position creates basic data for correction by comparison of said appointed position and positioning information received from the positioning system.

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METHOD AND ARRANGEMENT FOR CORRECTING POSITIONING INFORMATION

Technical field

The present invention describes an arrangement and a method to obtain improved positioning information with GPS. The invention utilises differential GPS (DGPS) to improve the positioning information from the GPS-system.

The mobile station combines Internet technology, mobile communication and an ordinary portable computer with a GPS-receiver to, by utilisation of the service logic in the network, obtain DGPS-data for the position of the mobile station.

The client must be connected to a communication network, for instance an IP-network, to obtain DGPS-data for correction. The client, however, need no specific DGPS-receiver, but said DGPS-data are transmitted by the IP-protocol to the client, which extracts and uses these data to determine the position.

Prior art

GPS is a commercial method that utilises satellites to obtain positioning information on the earth's surface with an accuracy of the order of 100 m. It is also known how one by means of differential GPS (DGPS) can obtain a more accurate positioning information from the GPS-system.

DGPS is based on that one from a known place, reference station (RS), continuously measures the size of the errors of the positioning signals from each GPS-satellite.

The DGPS-systems of today utilises radio communication in order to one-way transmit data to the terminals. There does

not exist any technology, which in a network based and bandwidth saving way makes possible two-way communication between reference stations and terminals so that the terminals can be provided with current data. The DGPS-systems for that reason operate with autonomous terminals, which have all information stored locally and receive positioning information from reference stations.

Technical problem

Positioning information can be obtained in different ways with different manual or automated methods, but with the methods that are utilised today it can be difficult to get sufficient accuracy of the positioning information. By GPS-systems one can have a positioning information with an accuracy of the order of 100 m. By DGPS-systems (Differential GPS) one can have an improved accuracy, but today existing DGPS-systems require that a specific receiver for correction data is utilised.

The systems of today, which utilise one-way communication from the central system to the user terminal, do not know where receiving terminal is located. This results in that DGPS-data that is lacking cannot be replaced by data from other reference stations, because the system does not know from which other reference station it shall draw correction data.

With one-way communication there neither is any possibility to transmit data for storing in the terminal, which results in that renewal of data will be difficult.

For want of communication possibilities the client has, in the systems that are used today, been adapted to utilise the bandwidth that can be expected to be available. By that the bandwidth is not optimally utilised.

All necessary statical information and all personal profiles must be stored in the terminal. By that the user must himself/herself make sure that all information that has been stored in the terminal is current. In addition to that this will cause some work for the user, there also will be a great risk that the stored information is out of date.

If a reference station is dropped/disappears, the possibility to utilise DGPS-data is lost, or reduced, in the systems of today.

Without utilising two-way communication it is not possible to distribute DGPS-data adapted to the client's position.

Technical solution

The invention that is described in this patent application includes software and a technical solution to distribute DGPS-data via the IP-protocol over an open data network, for instance Internet or other communication network.

The user starts the client program in his/her terminal at which, in a preferred embodiment, a map over the local surrounding is loaded down to the client. On the map is shown the user's position, corrected by means of a positioning correction function, for instance DGPS, which also is transmitted to the client over the data network.

The positioning correction is based on that one from a known place, a reference station (RS), continuously measures the size of the errors of the positioning signals from each GPS-satellite. The value that is measured is the propagation time of the signal from each GPS-satellite to the reference station. By knowing exactly where the

reference station is, it will be possible to calculate how long time it will take for the signal to reach the reference station from the satellite. The difference between the value that is measured, and the correct value, which is known by knowledge of the position of the reference station, constitutes DGPS-data.

The measuring are made for those satellites with which the reference station can communicate, i.e. those that are above the horizon and are not in a radio shadow region from the reference station. These DGPS-data are after that transmitted to the GPS-receiver, which, by means of the information, can correct its position. Owing to the fact that a reference station has a limited range, i.e. DGPS-data from an RS cannot be used too far from RS, a number of RSs are needed to cover a large area, se Figure 2, which shows the cover area for a number of reference stations over a geographical area.

The IP-protocol is used for the user terminal's/client's communication, which means that two-way communication is possible. This results in that the client has possibility to ask intelligent questions with regard to current position. The client therefore will request, derive and present information based on the mobile user's wishes, position, speed (i.e. speed and direction of movement).

In contrast to conventional DGPS, where RS transmits direct to the client, a server handles the communication both with RS and with client. The server then can communicate with a plurality of reference stations. By that it will be possible to supplement collected data if information from any RS is lacking. In the server correction data is stored from a plurality of reference stations, for instance in a correction database.

By the server communicating with the client, the client's location can be utilised to get an improved accuracy in the correction.

All information is filtered and prioritised so that only relevant data are transmitted. This results in that it will be possible to utilise mobile access via a medium with limited bandwidth, for instance GSM.

The client holds no stored statical information. Instead personal profiles, maps, information objects, web sites and correction data are derived, when necessary, from the service logic in the network. By this procedure the operator of the service logic can attend to that all information that is presented to the user is correct and of immediate interest. The user for that reason need not load information, maps, etc to his/her terminal. All such loading of necessary information and picture can be handled automatically by the client in co-operation with the service logic.

Advantages

A solution according to the invention will provide great advantages for both the one who is utilising the information, and the one who has information to distribute:

- Only standard components are needed to the user equipment: Access to Internet or other communication network, telephone, for instance mobile telephone such as GSM, GPS-receiver and simple (for instance portable) computer. No extra receiver for reception of data from differential GPS (DGPS) is needed since said data is distributed over a communication network, for instance Internet.

- By the information service according to the invention, data from differential GPS (DGPS) can be distributed over Internet, and no extra receiver is needed for this.

- All included units communicate in a preferred embodiment with TCP/IP, which makes it easy to distribute the system, i.e. to transmit client applications and data to the clients. If market, use and need of the invention is changed, the dimensioning of systems and services that realise the invention can easily be changed.

- By utilising the IP-protocol for the transmission, two-way communication can be utilised. The client then has possibility to ask intelligent questions with regard to current position so that transmitted amount of information is minimised and available bandwidth is used in best possible way. Since the client's location can be utilised, possibility is obtained for better accuracy in correction data.

- A server handles correction data and communication with both client and RS, in contrast to conventional DGPS where RS transmits direct to the client. In that way more reference stations can be utilised for the positioning correction (DGPS), and correction data for said stations can be stored in the server, for instance in a database.

- An arrangement according to the invention to generate DGPS-data and distribute data over IP can be created, implemented and maintained by simple means and by utilisation of modern technology.

- The client application can be designed so that it neither needs big local storing space or great processing resources.

- The invention is described for utilisation of GPS as positioning method, but other technology, for instance positioning by GSM or with other positioning system, which utilises satellites, for instance GLONASS, can be used.

- The system is quite non-autonomous, which means that the user does not need to have map data or other information stored in his/her terminal. All necessary data are transmitted to the user over the data network. By that, the operator of the system can attend to that the user will have access to current information, current maps etc.

- Personal settings are stored centrally in the service logic, which means that the user can utilise the positioning system in different places and with different equipment and yet meet the same man-machine interface. The user does not need to utilise the same client program or hardware to get access to his/her profile. Therefore it is possible to lease equipment according to the invention and the user will have access to his/her personal profile. Leasing cars can be equipped with a client according to the invention, and the user will have access to his/her personal profile.

- Operation, maintenance and further development are facilitated by that upgrading/updating and other changes need only be made in one place. The client systems will be automatically updated or reloaded in connection with that they are utilised.

- The information is always current/up to date and easy to update because it is stored in the network instead of with the client.

- The client function can be developed in Java, which makes it platform independent and that there are no specific demands on the design of the mobile terminal.

- The possibility for modular design with well specified interfaces makes the maintenance easy. By utilising the IP-protocol between the included blocks, the system will be scalable and can in an easy way be arranged to handle different numbers of clients, The described architecture also makes load division for distribution of DGPS-data to many clients possible.

- If a reference station is dropped/disappears, or if different circumstances, for instance the weather, makes it more difficult for a certain RS to receive signals from certain satellites, the system solution according to the invention makes possible that DGPS-data are supplemented with data from other closely located reference stations, since the client's position is known.

- In places or in situations where GPS-coverage is poorer, it is especially important that DGPS-data can be supplied just for the (sometimes few) satellites the receiver sees. By the method described in the invention, the probability will increase for that the client shall get access to good DGPS-data.

- By means of two-way communication, which according to a preferred embodiment is made by the IP-protocol, it will be possible to, to each client, transmit DGPS-data that have been adapted to the client's position,

which is not possible with the radio systems that are utilised today.

- A user of the mobile information service need not invest in a separate DGPS-receiver, but can obtain DGPS-data automatically when the client software starts, if a GPS-receiver is connected to the terminal.

List of Figures

Figure 1 shows an overview of the parts of the system.

Figure 2 shows an example of the coverage of reference stations.

Figure 3 shows the architecture of distribution of DGPS-data over IP-networks.

Figure 4 shows a system overview of the client system.

EXPLANATION OF TERMS

DGPS	Differential GPS; device to, by means of the GPS-system, obtain improved positioning information.
GCB	(GPS Correction Block) Block for GPS-correction.
GLONASS	Positioning System.
GPS	Global Positioning System.
GSM	Global System for Mobile Communication.

	(Cellular mobile telephone system)
IP	Internet Protocol. Protocol that is used in Internet.
Java	An object oriented, platform independent program language.
Multicast	Transmission to a group of receivers.
RS	Reference Station for positioning correction in DGPS.
SB	Server Block. Block for server functions.
TCP	Transport Communication Protocol.
TEB	Terminal Equipment Block. Block for user equipment, terminal unit.

DETAILED DESCRIPTION

The description below refers to the Figures in the appendix of drawings.

GPS and DGPS

GPS is a system for positioning/position finding and that is able to operate all over the world. By a GPS-receiver, anyone can receive satellite signals that give information about the receiver's position, speed and direction.

By GPS (Global Positioning System) the user will have information about the position, on land, at sea, or in the

air. Satellites that are circulating round the globe transmit radio signals, which are received by a GPS-receiver. The GPS-receiver then utilises the information to calculate position, speed and direction.

GPS is built of three main parts: Satellite part, control part and user part.

24 GPS-satellites are circulating round the globe, 21 of which are used, and three are back up satellites, which are at disposal if any of the ordinary ones should fail. The satellites are in different orbits at an altitude about 20 000 km to secure that almost always at least four satellites shall be visible from a GPS-receiver, wherever it is on the earth. On board the satellites there are control and radio equipment and atomic clock, which attends to that the time information that is transmitted is as accurate as possible.

The control part comprises six control stations on the earth. These are utilised to detect errors, disturbances and above all to supply basic data to correct transmitted time information.

The user part consists of a GPS-receiver that can be compared to an ordinary radio receiver with a computer and a clock.

The GPS-satellites transmit radio signals, which include information about:

- which satellite it is (satellite ID),
- the condition of the satellite (faultless/damaged)

- information to calculate or in any other way derive the exact position of the satellite,

- the point of time when the signal has been transmitted.

The signals are received by the user's receiver, which, by means of information from a plurality of different satellites, can calculate the distance to the satellites. With three satellites, one can get two possible positions, only one of which is on the surface of the earth. Normally three satellites consequently are needed by the receiver to give an unambiguous position indication. A fourth satellite is used to make it possible for the receiver to calculate the error in its built-in clock and compensate for it. This is of outmost importance, because even small errors can have decisive consequences for the positioning, since the propagation time of the signals from the satellite is included in the calculation of the position.

DGPS, or differential GPS, has been developed in order to improve the accuracy at positioning. This can be achieved by utilisation of reference stations with accurately appointed positions. The reference stations compare their known position with the position that is indicated by a GPS-receiver at the station to calculate the error in the satellite signals. If the error exceeds a certain tolerance level, a correction signal, that is utilised by DGPS-receivers in the area, is transmitted.

BRIEF DESCRIPTION OF THE INVENTION

<u>The perspective of the server</u>

The invention describes an arrangement to, at a wireless communications system, provide a mobile client (11) with

best possible DGPS-data. The arrangement is built up as a client-server solution. To each server (10) a plurality of clients (11) can be connected, which makes the system scalable. To the server the clients will connect, and all communication is passing via this server.

The server (10) is in its turn connected to a database (13) containing current correction data. These correction data are updated continuously by the reference stations (14) that are connected. Correction data are transmitted to the client via Internet (15), or other communication network. This leads to that it is always current information that is transmitted to the user.

The user is equipped with a terminal (client computer, 11) with functionality for data communication, for instance GSM, positioning system (16), for instance GPS, for instance an ordinary portable computer, and access to Internet (15), or other data network, via a telephone, preferably a mobile telephone, for instance GSM.

Necessary software for the positioning system shall be in operation at the client computer. The software can easily be taken into operation for instance by loading via Internet from service supplier's website and subsequent local installation.

The user sets up a connection to Internet. The client software reads the position from the GPS-receiver (16) and transmits the position to the server (10).

The position is received in the server block, SB (Figure 3), which forwards the position to positioning correction, GCB (Figure 3). GCB decides which reference station, RS1, RS2,… (Figure 3) that shall be used to correct the user's

position. About ten RSs are needed to cover Sweden (see Figure 2).

SB (Figure 3) registers for each user which RS that is best for the user with regard to current position and other conditions. If the user moves so that another RS is more suitable, the stored information about best RS is updated. Correction data is transmitted regularly, for instance every 10^{th} second, to the client (11). The time interval for transmission of these correction data is determined based on the speed by which the client is moving. The client software puts this through to the GPS-receiver (16) via a standardised protocol (RTCM). The GPS-receiver calculates itself its exact position with regard to correction data from RS, which results in that the error can be reduced to a few meters.

The perspective of the client

When a client starts, it connects to a server that handles the communication with the client. The client's position is obtained by means of a receiver (16), which receives a first positioning information from the positioning system (18), for instance from the GPS-system by GPS-satellites. By an ordinary GPS-receiver, the position will be indicated with an error that can be 100 m. It means that one in a town cannot be sure of in which part of the town one is. By means of a correction system, such as differential GPS, DGDPS, one can achieve a better accuracy.

By a network of reference stations, correction data are derived. These correction data are transmitted to the clients, which forward them to their receivers for the positioning system. In the receivers the information is utilised to create a more accurate positioning.

According to the invention, correction data are transmitted via Internet, which results in that no extra equipment, beside the receiver for the positioning system, for instance GPS-receiver, need to be connected to handle correction data, and no specific subscription is needed for the correction.

Correction data are normally transmitted in a specific format, RTCM, which is a standard protocol that is used for communication with GPS-receivers.

The functions of the information service are implemented in a platform independent program language, for instance Java. The system therefore will function with a plurality of different operative systems and hardware, and by that it is also easy to change operative system and hardware for the different parts of the system.

All communication is executed by means of TCP/IP, which is used on Internet. This means that the parts need not be at the same physical place, and that it is easy to connect to the server.

Technical construction

The server block, SB (Figure 3), is the central unit from which the terminal units, TEB, (Figure 3), update their information. All communication between the function blocks is passing via SB.

The block for the terminal units, TEB (Figure 3), constitutes the user's man-machine system. In and out data are put through to and from the user via TEB. Connection to SB is made, in a preferred embodiment, by the TCP/IP-protocol over mobile communication network, for instance

GSM. A GPS-receiver (16) is connected to TEB to receive the position of the terminal unit.

The block for GPS-correction, GCB (Figure 3), derives and provides the system with information about positioning correction from external units. GCB can handle a plurality of external units. Each unit receives the positioning information from a GPS-receiver and calculates the positioning correction by knowledge of the real position.

PREFERRED EMBODIMENT

The server has access to information concerning all reference stations. The information can be represented in a matrix with a summary of which satellites the reference stations can reach, and how big propagation time error each visible satellite has at this reference station (RS).

Logically the table can look like below.

	Satellite 1	Satellite 2	Satellite 3	Satellite n	Satellite (n+1)
RS1	-3ns	+5ns	-4ns	-22ns	
RS2	+2ns	0	-45ns		
RS3	+12ns	+23ns	-4ns	-5ns	0
RSn	-3ns	5ns	etc	etc	etc
RS n+1	etc	etc	etc	etc	etc

Because the server has access to the geographical position of the mobile terminal (client), the time errors of the closest reference station can be derived.

If this RS, owing to physical obstacles, or for any other reason, cannot get into contact with sufficient number of satellites, the next closest RS is checked, and lacking

values are derived from this RS. This procedure is repeated for each next RS until all time errors for all satellites have been derived and registered in, for instance, a data vector.

The data vector contains the time errors for each satellite and the position of the reference station (RS) from which the value has been derived. The values are checked in the client, and values that have been derived from reference stations located very far from the client can be neglected, or be given less significance.

The position of the reference station is used at correction to make it possible for the client to decide which DGPS-data that are suitable to use at calculation of the exact position. If not all DGPS-data are needed for the correction calculations, values of distant RSs can be neglected to avoid that data from these distant reference stations reduce the accuracy of the positioning information.

The client receives DGPS-data from the server and transmits these data to the GPS-receiver, often in RTCM-format. The client can choose to throw away certain DGPS-data that do not add precision to the positioning. The GPS-receiver corrects the position with regard to received DGPS-data and after that informs the client computer whether the correction has succeeded, or if it cannot calculate corrected geographical position.

By this arrangement is guaranteed that best possible and greatest possible number of DGPS-data are transmitted to the client. In that way the client's GPS-receiver will have optimal possibility to correct its position. To make it possible for the GPS-receiver to correct its position, received DGPS-data must apply to exact the satellites that

the client's GPS-receiver sees. By the method according to the invention, the number of DGPS-data that correlates to the satellites the GPS-receiver sees, are maximised.

The client's positioning/position indication includes, in addition to information about position, also information about the accuracy of the positioning. The accuracy can be presented to the user in three levels:

- the client does not receive any position from the GPS-receiver,
- the client receives positioning information from the GPS-receiver, but DGPS-data are not available, which means that the error in the positioning usually is less than one hundred meter,
- the client receives positioning information from GPS at the same time as DGPS-data are available, which means that the error in the position is only 10-20 meters.

System architecture

The overall architecture for distribution and generation of DGPS over IP is evident from Figure 3. Communication between the blocks is made by means of packet switching, for instance TCP/IP. On top of TCP Java flows are used to transmit the information.

The system consists of a number of reference stations, which, via an IP-network, is connected to "GPS Correction Block" (GCB). As spider in the net is a "Server Block" (SB), which handles the traffic and exchange of messages between GCB and "Terminal Equipment Block" (TEB).

Reference station (RS)

The reference stations are continuously calculating the time error for each satellite they can communicate with. All reference stations regularly supply data to GCB. Each RS derives DGPS-data for a certain geographical region. RS and GCB communicate over IP, so GCB can be in an area far from the reference stations.

GPS Correction Block (GCB)

The task of GCB is to continuously put together DGPS-data from all reference stations and arrange a table for each geographical area with latest DGPS-data for each satellite.

There can be a plurality of GCBs in the system and all hold an updated picture of DGPS-data for all reference stations. This can easily be done, because the amount of data that shall be distributed is very small (satellite-ID and time error information for normally less than 12 satellites).

A multiple of GCBs can be used to achieve division of load.

Server Block (SB)

The server block regularly derives DGPS-data from GCB to after that transmit data to clients in question.
To make it possible for SB to know to which clients different DGPS-data shall be transmitted, all to SB connected clients are associated to different geographical regions. The geographical region to which a client is associated is determined by which RS that is closest to the client.

Also the time interval for transmission of DGPS-data is registered for each client. This time interval can i.a. be

influenced by the user's wishes by setting by the client and by the client's speed.

SB derives DGPS-data per geographical region and wanted updating interval from GCB and transmits these to each client by Java streams over TCP/IP. The amount of data is very small, and the consumption of bandwidth will be negligible. If the client is connected to an IP-network that supports multicast, DGPS-data are distributed by multicast to all clients within a certain geographical region.

There can be a multiple of SBs in the system to achieve division of load.

Terminal Equipment Block (TEB)

TEB extracts DGPS-data from the Java stream and converts these data to RTCM-format (a standard protocol for GPS-receivers to receive DGPS-data). These data in RTCM-format are transmitted to the GPS-receiver, which finally calculates the exact position and transmits the position information to the client computer.

SYSTEM DESCRIPTION OF THE CLIENT

The client system can be described in a number of blocks, see Figure 4.

Main block (41)

The main block (41) is the biggest part of the system and the central component. In this block i.a. the graphical user interface, communication functions, for instance

Internet communication, and conversion between the different blocks, are handled.

Positioning block (42)

The positioning block (42) is the client's supplier of position. To this block positioning data from the GPS-receiver, and correction data (DGPS) from the service logic, are transmitted. This block also attends to that the client is updated continuously with correct positioning information.

GPS-communication (43)

Direct communication with the GPRS-receiver is made via this block (43). Because the block is separated it is easy to introduce another positioning technology into the system (for instance GSM-positioning).

Information agent (44)

The information agent (44) is a separate component that updates the system with current information objects. The information agent consequently attends to that the client always has right information, based on the user profile and current position.

User agents

The system can be supplemented with more separate components in form of agents such as a map agent.

The basic function in a map agent can be to provide an updated map to the client. The agent asks "intelligent" questions, which then are transmitted to the service logic. When the answer is received, the agent attends to that the

map objects (map segments) are organised and put together to a complete map of the area.

The invention is not restricted to the above described embodiments, but may in addition to that be subject to modifications within the frame of the following patent claims and the idea of invention.

PATENT CLAIMS

1. An arrangement, at a wireless communication system, to, by utilisation of positioning system (18), supply a mobile user client (11) with corrected positioning information by adjustment of a first positioning information, which is obtained from said positioning system, c h a r a c t e r i s e d in that said adjustment corrects for imperfections in the positioning system and is depending on the user client's position.

2. An arrangement as claimed in patent claim 1, c h a r a c t e r i s e d in that the user client communicates over a two-way connection with device (10), which supplies data for said adjustment of said first positioning information.

3. An arrangement as claimed in patent claim 2, c h a r a c t e r i s e d in that said communication between user client and said device is made over an open computer network (15), for instance Internet or other computer network that utilises the IP-protocol.

4. An arrangement as claimed in patent claim 2, or 3, c h a r a c t e r i s e d in:

- that said positioning system is built up of transmitter (18), which transmits positioning information,
- that reference stations (14) with accurately appointed position create first basic data for adjustment of a first positioning information by comparison of said appointed position and

positioning information received from the positioning system.

- that said device obtains, from said reference stations, said first basic data for adjustment,

- that said device registers and stores current first basic data for adjustment regarding a plurality of transmitters that are included in said positioning system, and

- that said device from these stored current first basic data for adjustment, for each mobile user client, extracts said data for said adjustment.

5. An arrangement as claimed in patent claim 4, c h a r a c t e r i s e d in that said first basic data for adjustment is a measure of time that is depending on the propagation time for the signal between satellite and reference station.

6. An arrangement as claimed in patent claim 4, or 5, c h a r a c t e r i s e d in that, if positioning information, or basic data for adjustment of positioning information, is lacking from transmitter in the positioning system, data from other transmitters or other reference stations are utilised to provide the mobile user client with corrected positioning information.

7. An arrangement as claimed in any of the previous patent claims, c h a r a c t e r i s e d in that said positioning system is a satellite based positioning system, for instance GPS.

8. An arrangement as claimed in any of the previous patent claims, c h a r a c t e r i s e d in simple user equipment consisting of personal computer with communication possibility in an open computer network, for instance Internet, and receiver adapted to said positioning system.

9. A method to, with utilisation of a positioning system for mobile terminals (11), optimise the accuracy of the positioning for said terminal, c h a r a c t e r i s e d in that the terminal equipment receives positioning information from said positioning system and that said positioning information is adjusted with regard to the geographical position of the terminal equipment, and to imperfections in the positioning system.

10. A method as claimed in patent claim 9, c h a r a c t e r i s e d in that basic data for adjustment of positioning information are registered and kept updated in one or more databases (13), that data for adjustment of positioning information is transmitted to the terminal equipment and that said data for adjustment are influenced by the position of the terminal equipment, by status for the positioning system, and by imperfections of data that are received from the positioning system.

11. A method as claimed in patent claim 10, c h a r a c t e r i s e d in that the communication between the terminal equipment and said database is made two-way, for instance over an open data network (15).

12. A method as claimed in any of the patent claims 9 to 11, c h a r a c t e r i s e d in:

- that said basic data for adjustment of the positioning information are obtained from a plurality of reference stations (14), which have well known positions.

- that information about the exact position of the reference stations and the information of the positioning system about the position of the reference stations are utilised to create said basic data for adjustment of the positioning information, and

- that said basic data for adjustment of the positioning information from a plurality of reference stations are stored in said database.

13. A method as claimed in any of patent claims 9 to 12, c h a r a c t e r i s e d in that said adjustment of positioning information is based on the position, speed and direction of movement of the terminal equipment, and the wishes of the user.

14. A method as claimed in any of patent claims 9 to 13, c h a r a c t e r i s e d in that data that are lacking from any reference station can be replaced by data from other reference stations.

15. A method as claimed in any of the patent claims 9 to 14, c h a r a c t e r i s e d in that no static information, such as personal profiles, maps, information objects, web sites and correction data, are stored in the terminal equipment.

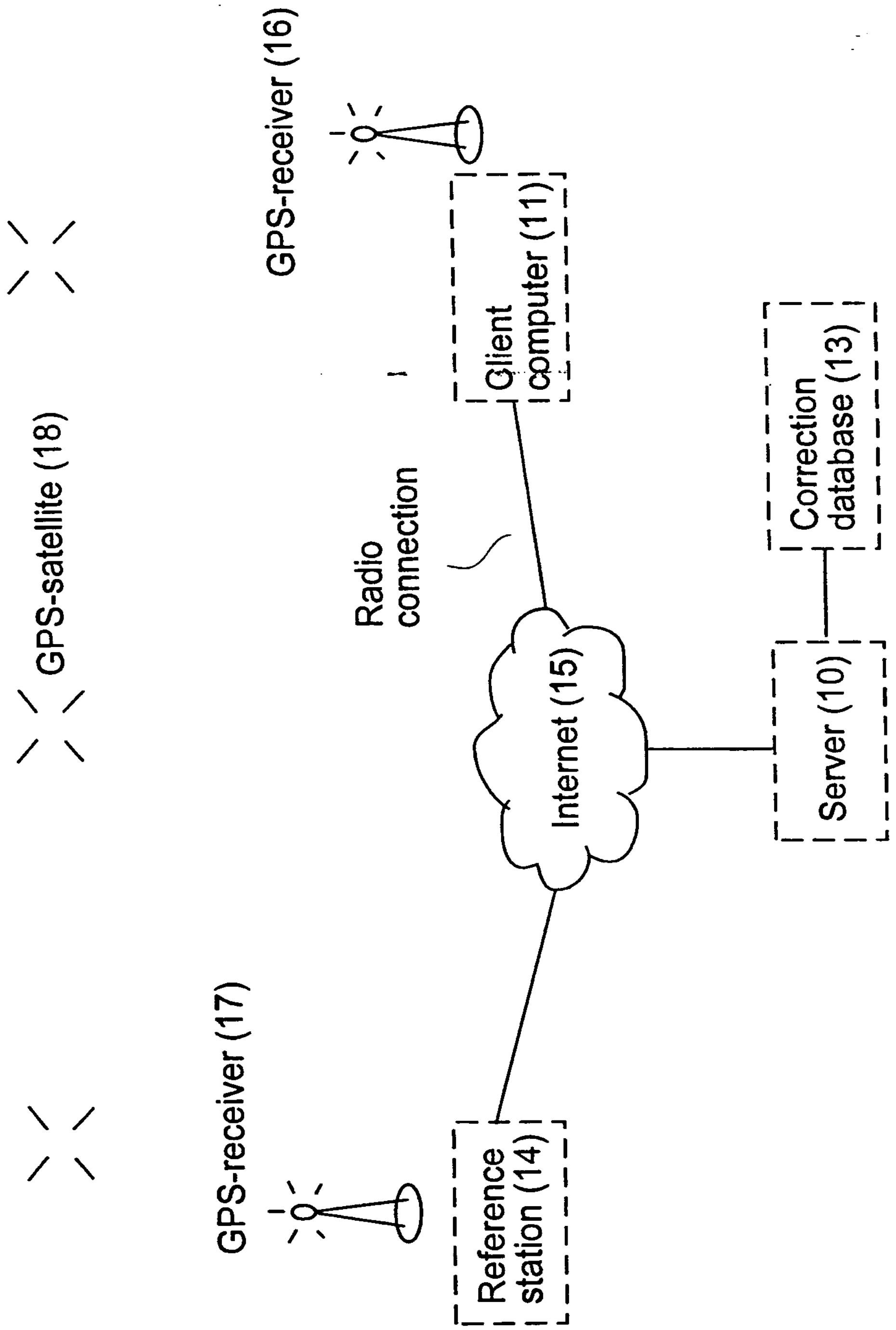
GPS-satellite (18)
GPS-receiver (16)
Client computer (11)
Radio connection
Correction database (13)
Internet (15)
Server (10)
GPS-receiver (17)
Reference station (14)

Figure 1

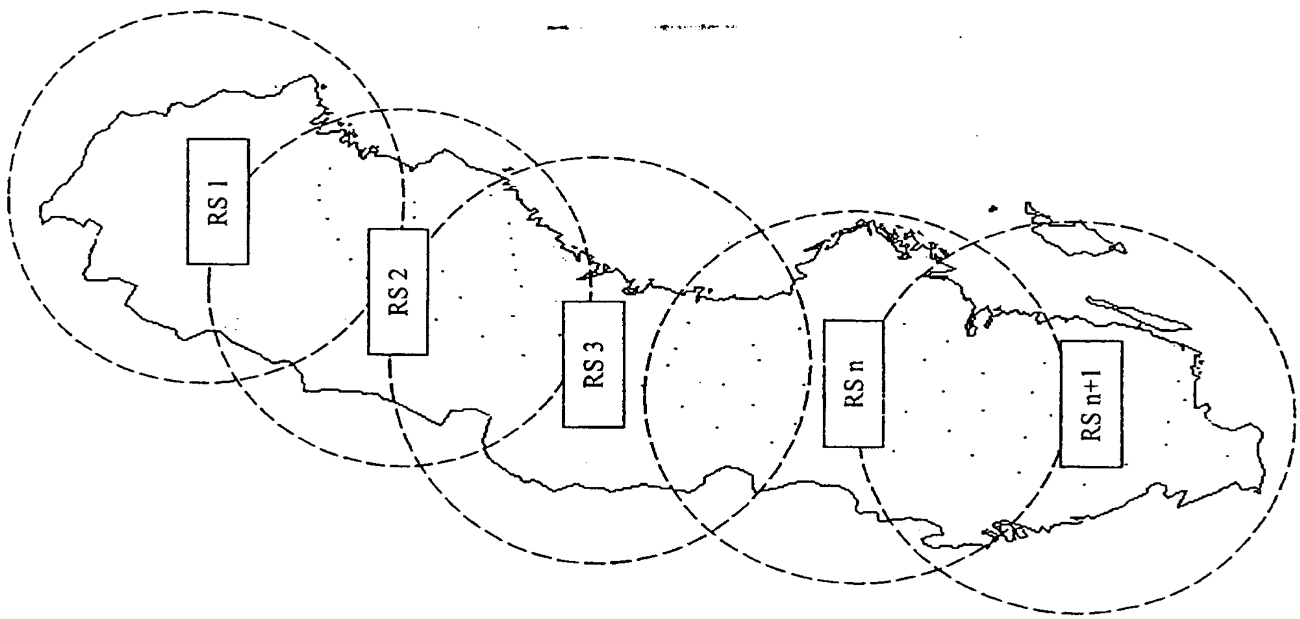

Figure 2

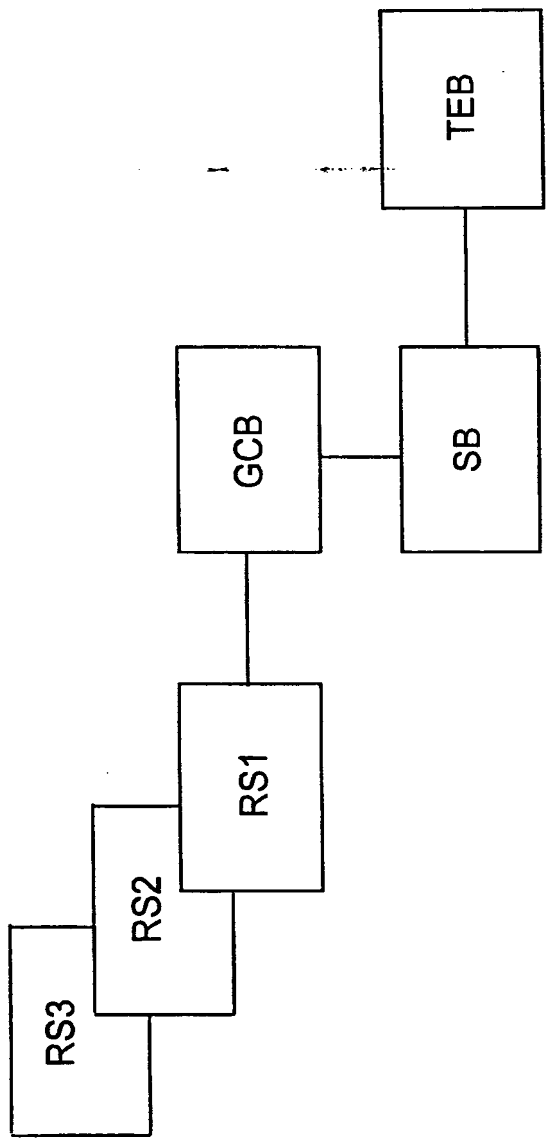

Figure 3

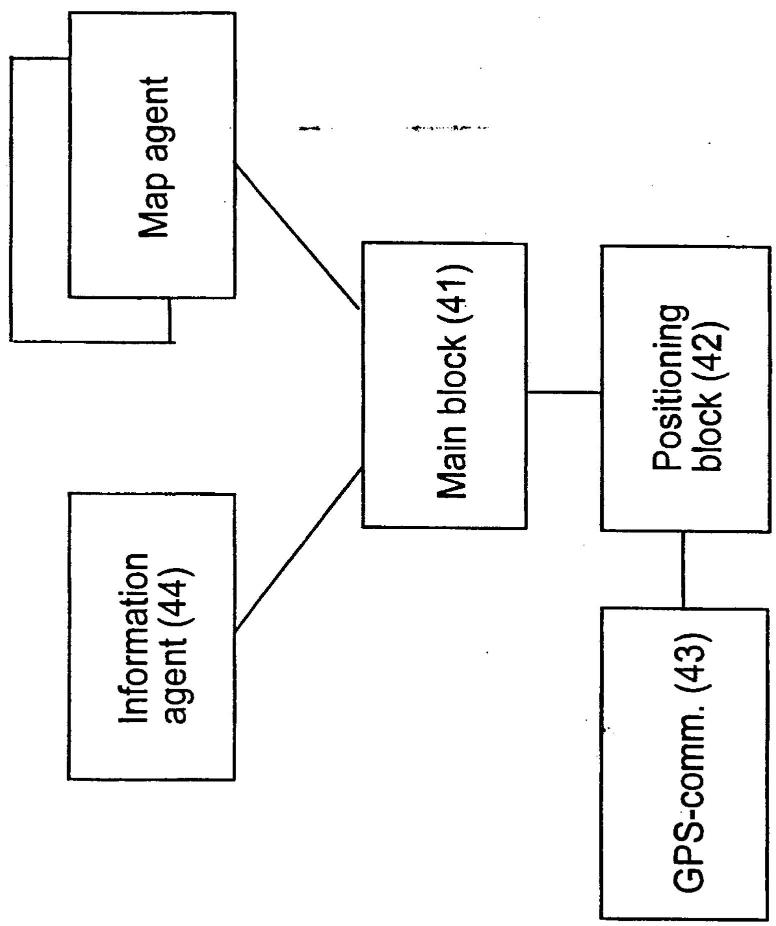
Map agent
Information agent (44)
Main block (41)
Positioning block (42)
GPS-comm. (43)

Figure 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/01181

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G01S 5/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G01S

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5563607 A (P. VAN WYCK LOOMIS ET AL), 8 October 1996 (08.10.96), column 3, line 51 - line 66; column 8, line 45 - line 53, figure 6	1,2,4-7, 9-12,14
Y		3,8
	--	
Y	Patent Abstracts of Japan, abstract of JP 9-311177 A (SEKO EPSON CORP), 2 December 1997 (02.12.97)	3,8
	--	

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" erlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 Sept 2000	21-09-2000
Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/01181

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	VALEJO A. et al, "Short-range DGPS for mobile robots with wireless Ethernet links", In: AMC 98-Coimbra, 1998 5th International Workshops onAdvanced Motion Control, 1998, pp 334-339, see especially p. 337 --	3,8
X	Patent Abstracts of Japan, abstract of JP 11-72348 A (Seiko epson corp), 16 March 1999 (16.03.99) --	1-3,7-9,15
A	US 5323322 A (K. TYSEN MUELLER ET AL), 21 June 1994 (21.06.94), abstract --	1-15
E,X	SE 9900531-6 (TELIA AB) 18 August 2000 (18.08.2000) page 11, line 28 - page 12, line 14; page 13, line 16 - page 14, line 24 -- --------	1-15

INTERNATIONAL SEARCH REPORT
Information on patent family members

01/08/00

International application No.
PCT/SE 00/01181

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5563607 A	08/10/96	NONE	
US 5323322 A	21/06/94	NONE	